



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.06.2009 Bulletin 2009/23

(51) Int Cl.:
A61C 7/14 (2006.01)

(21) Application number: **08169008.3**

(22) Date of filing: **13.11.2008**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**
Designated Extension States:
AL BA MK RS

(30) Priority: **28.11.2007 CN 200710114988**
11.01.2008 CN 200810002164

(71) Applicant: **Song, Zhichun**
Qingdao Shandong 266061 (CN)

(72) Inventor: **Song, Zhichun**
Qingdao Shandong 266061 (CN)

(74) Representative: **Savolainen, Seppo Kalevi**
Kolster Oy Ab
Iso Roobertinkatu 23,
P.O. Box 148
00121 Helsinki (FI)

(54) **Orthodontic appliance**

(57) Disclosed herein relates to an orthodontic appliance, in particular to an orthodontic appliance connected to a tooth and coacting with an archwire. The orthodontic appliance has at least one archwire slot extending through mesiodistally. At least one sub-slot opening to the archwire slot is provided in the sidewalls of the archwire slot. The above-mentioned configurations facilitate

the movement of the tooth mesiodistally. With different archwires and different ligation manners, the position of the archwire in the archwire slot can be controlled, thus it is easy to tip teeth mesiodistally and to upright the teeth mesiodistally with small force. The orthodontic appliance has simple structure, and with which it is not necessary to employ extraoral force and mini-implant to strengthen the anchorage.

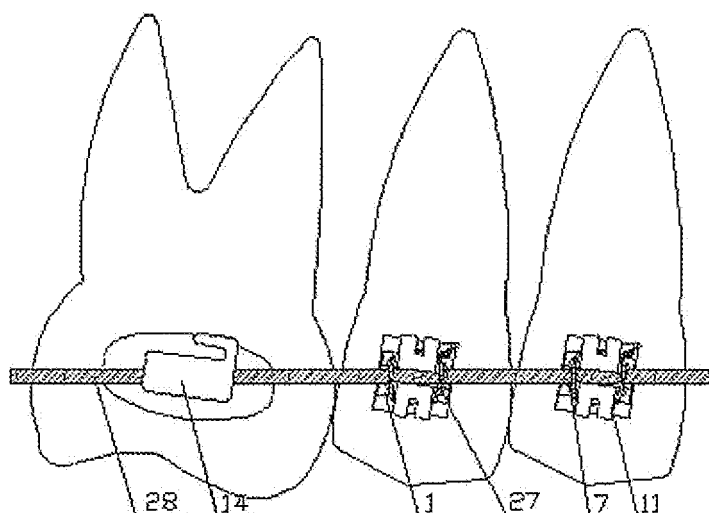


Fig. 11

Description

CROSS-REFERENCES TO RELATED APPLICATIONS

- 5 **[0001]** This application claims the benefits of Chinese Applications No. 200710114988.4 filed on November 28, 2007 and No. 200810002164.2 filed on January 11, 2008.

TECHNICAL FIELD

- 10 **[0002]** The invention relates to an orthodontic appliance for producing tooth movement, and more particularly to an orthodontic appliance coacting with an archwire for producing mesiodistal tooth movement through tooth tipping and uprighting movements.

BACKGROUND OF THE INVENTION

- 15 **[0003]** The Edgewise and the Begg techniques are currently the most common ones in use. Although all forms of Edgewise technique use Edgewise brackets with horizontally extending archwire slots, the most popular form is known as the straight wire technique. Limited free tipping action with Edgewise brackets occurs only when an archwire smaller than the archwire slot is employed, resulting in a loose fit between the archwire and the slot. In contrast, the bracket configuration for the Begg technique utilizes a vertically extending slot, which permits greater free tipping of teeth than the Edgewise brackets.

- 20 **[0004]** Moving teeth mesiodistally to close a space between two teeth is a common practice in an orthodontic clinic. The Edgewise technique uses the bodily movement of teeth to close a space, while Begg and Tip-edge technique use tipping the clinical crowns towards the open area followed by an uprighting the roots to their predetermined inclination. It is well known that the forces needed, discomfort, and time required for closing spaces by tipping and uprighting movements are much less than that required for bodily moving the teeth.

- 25 **[0005]** In the uprighting movement with Begg and Tip-edge technique, the uprighting springs or auxiliary archwires are needed to move the root to the right position. These two procedures are inconvenient and complicated so that they are not widely practiced in the clinic.

- 30 **[0006]** US patent No. 4877398 published on October 31, 1989 discloses an orthodontic bracket which can tip tooth mesiodistally using small force without employing extraoral anchorage and implant anchorage to improve anchorage, and allow to open anterior overbite quickly and effectively. However, it is cumbersome and difficult to upright a tooth root mesiodistally because this technique requires an uprighting spring to upright the inclined teeth during the final stage of the treatment.

35 SUMMARY OF THE INVENTION

- [0007]** The technical problem to be solved by the present invention is to design an orthodontic appliance which can move teeth mesiodistally by using small force without employing extraoral anchorage or implant anchorage to strengthen the anchorage and can upright the teeth easily without employing additional uprighting springs and auxiliary archwires.

- 40 **[0008]** For solving the above problem, the present invention provides an orthodontic appliance. The orthodontic appliance has a base connected to the crown of a tooth and coacts with an archwire passing through the appliance mesiodistally. The appliance has at least one archwire slot extending through the appliance mesiodistally. The archwire slot has a bottom wall and sidewalls which include an occlusal sidewall and a gingival sidewall being parallel to each other. The archwire slot has at least one sub-slot which is located in the sidewalls of the archwire slot and opens to the archwire slot. At least one end of the sub-slot starts from the mesial edge or the distal edge of the sidewalls of the archwire slot. The buccolingual width of the sub-slot is at least in some section smaller than that of a rectangular archwire employed for uprighting teeth, and the configuration of the sub-slot is adapted to allow a round archwire to enter the sub-slot when the tooth is tipped.

- 50 **[0009]** In this document the term "buccolingual" refers to "labiolingual or buccolingual", and the term "buccal side" refers to "buccal side or labial side".

- [0010]** The orthodontic appliance of this invention is a combination of Begg technique and Edgewise technique. Tipping tooth movement and bodily tooth movement both can be achieved by using the orthodontic appliance with different archwires. This orthodontic appliance is easily constructed and is convenient to use.

- 55 **[0011]** According to the orthodontic appliance of the present invention, the largest mesiodistal inclination of the tooth is limited by the buccolingual width and the occlusogingival depth of the sub-slot as well as the shape and size of the archwire employed in the appliance.

- [0012]** According to the orthodontic appliance of the present invention, the sub-slot fits the round wire very well when

a tooth is tipped.

[0013] According to the orthodontic appliance of the present invention, the buccolingual width of the sub-slot is smaller than that of the rectangular archwire for uprighting teeth so that the rectangular wire can not enter into the sub-slot when uprighting a tooth.

[0014] According to the orthodontic appliance of the present invention, the archwire is generally parallel to the occlusal plane.

[0015] According to the orthodontic appliance of the present invention, the archwire slot extends horizontally.

[0016] According to the orthodontic appliance of the present invention, the orthodontic appliance may be used as a labial orthodontic appliance or a lingual orthodontic appliance.

[0017] According to the orthodontic appliance of the present invention, the appliance may have a limiting member for limiting the archwire in the archwire slot. The limiting member may be a ligation device, a self-locking device, or a cover of the archwire slot. Alternatively, the ligation device and the cover can be used together as the limiting member.

[0018] According to the orthodontic appliance of the present invention, the appliance may have a ligation device, and the ligation device may have one pair of tie wings or two pairs of tie wings or three pairs of tie wings.

[0019] According to the orthodontic appliance of the present invention, the sidewall is formed on the buccal side and the lingual side of at least part of the sub-slot.

[0020] According to the orthodontic appliance of the present invention, the sidewall is formed on the buccal side and the lingual side of the sub-slot.

[0021] According to the orthodontic appliance of the present invention, the sub-slot may be next to the bottom wall only at the mesial edge and the distal edge of the sidewalls.

[0022] According to the orthodontic appliance of the present invention, at least part of the sub-slot is separated from the bottom wall by the sidewall.

[0023] According to the orthodontic appliance of the present invention, the sub-slot is separated from the bottom wall by the sidewall.

[0024] According to the orthodontic appliance of the present invention, the median line of the section on the sidewall plane of the sub-slot is substantially parallel to the bottom wall, wherein the distance between the median line and the bottom wall is equal to or a little larger than the radius of the round wire employed for tipping teeth.

[0025] According to the orthodontic appliance of the present invention, the median plane of the sub-slot divides the sub-slot which is bilaterally symmetrical into labial and lingual halves, wherein the median plane is parallel to the bottom wall.

[0026] According to the orthodontic appliance of the present invention, at least most of the sub-slot is bilaterally symmetrical, and a plane which is parallel to the bottom wall divides the symmetrical part of the sub-slot into labial and lingual halves.

[0027] According to the orthodontic appliance of the present invention, the median plane of the sub-slot is substantially perpendicular to the occlusal plane.

[0028] According to the orthodontic appliance of the present invention, the diameter of the round wire for tipping teeth usually is 0.016 inch or 0.018 inch, the diameter of a round wire for tooth aligning usually is 0.012 inch or 0.014 inch, and the type of the rectangular wire for uprighting teeth usually is 0.019 inch * 0.025 inch or 0.017 inch * 0.025 inch.

[0029] According to the orthodontic appliance of the present invention, the distance between the median plane of the sub-slot and the bottom wall is substantially equal to the radius of the round wire employed for tipping teeth.

[0030] According to the orthodontic appliance of the present invention, the sidewall between the sub-slot and the bottom wall may hinder the thin round wire to enter the sub-slot especially under tight ligation.

[0031] According to the orthodontic appliance of the present invention, the sidewall between the sub-slot and the bottom wall has the smallest buccolingual width at the mesial edge and the distal edge of the sidewalls and gradually become wider mesiodistally, and has the largest buccolingual width in the middle of the sidewall.

[0032] According to the orthodontic appliance of the present invention, the sidewall between the sub-slot and the bottom wall is very helpful for uprighting and torquing teeth when employing a rectangular wire, and may hinder the rectangular wire to enter the sub-slot.

[0033] According to the orthodontic appliance of the present invention, the buccolingual width of the sub-slot may vary from zero to the width larger than the diameter of the round wire employed for tipping teeth, and the round wire may partially enter the sub-slot of which the buccolingual width is smaller than the diameter of the round wire, but the rectangular wire can not enter the sub-slot of which the buccolingual width is smaller than that of the rectangular wire.

[0034] According to the orthodontic appliance of the present invention, the diameter of the round wire employed for tipping teeth is larger than that of the round wire employed for aligning teeth, and the diameter of the round wire employed for tipping teeth is smaller than the buccolingual width of the rectangular wire.

[0035] According to the orthodontic appliance of the present invention, the sub-slot may have the largest occlusogingival depth at the mesial edge and the distal edge of the sidewalls and gradually become shallower mesiodistally.

[0036] According to the orthodontic appliance of the present invention, the orthodontic appliance may be a self-ligation

orthodontic appliance, or may be an Edgewise orthodontic appliance or a straight-wire orthodontic appliance. This invention may also be used in combination with any other kinds of general orthodontic appliances.

[0037] According to the orthodontic appliance of the present invention, the orthodontic appliance may be made of metal, ceramic or plastic etc., or may be made of any combination of the material mentioned above, or may be made of any other machinable material.

[0038] According to the orthodontic appliance of the present invention, the orthodontic appliance may be connected to an anterior tooth, a bicuspid or a molar, and the orthodontic appliance may be a bracket or a molar tube.

[0039] According to the orthodontic appliance of the present invention, the archwire slot may be a slot or a tube.

[0040] According to the orthodontic appliance of the present invention, the sub-slot extends mesiodistally.

[0041] According to the orthodontic appliance of the present invention, the sub-slot may extend through the sidewalls mesiodistally up to the distal edge or the mesial edge on the other side of the sidewalls, or may also extend mesiodistally and germinate in the sidewalls.

[0042] According to the orthodontic appliance of the present invention, the sub-slot extends occlusogingivally.

[0043] According to the orthodontic appliance of the present invention, the sub-slot may extend through the sidewalls occlusogingivally, or may extend occlusogingivally and terminate in the sidewalls.

[0044] According to the orthodontic appliance of the present invention, the sub-slot may be located on a continuous sidewall or a discrete sidewall of the archwire slot.

[0045] According to the orthodontic appliance of the present invention, when the sub-slot is located in a discrete sidewall, one end of the sub-slot may start from the mesial edge of the mesial section of the sidewall or the distal edge of the distal section of the sidewall.

[0046] According to the orthodontic appliance of the present invention, the bottom wall of the archwire slot may extend beyond the archwire slot mesially and/or distally.

[0047] According to the orthodontic appliance of the present invention, the sub-slot may have the largest buccolingual width at the mesial edge and the distal edge of the sidewalls of the archwire slot and gradually become narrower mesiodistally.

[0048] According to the orthodontic appliance of the present invention, the shape of the cross section perpendicular to the mesiodistal direction of the sub-slot may be triangular, arc, trapezoidal or rectangular.

[0049] According to the orthodontic appliance of the present invention, the cross sections perpendicular to the mesiodistal direction of the same sub-slot in the different site may be identical or may be different.

[0050] According to the orthodontic appliance of the present invention, the sidewalls are perpendicular to the bottom wall.

[0051] According to the orthodontic appliance of the present invention, there may be following configurations relating to the position and the number of the sub-slots.

1. At least one sub-slot starts from the distal edge of the occlusal sidewall of the archwire slot;
2. At least one sub-slot starts from the mesial edge of the gingival sidewall of the archwire slot;
3. At least one sub-slot starts from the mesial edge of the occlusal sidewall of the archwire slot;
4. At least one sub-slot starts from the distal edge of the gingival sidewall of the archwire slot;
5. Any combination of two or more than two above-mentioned configurations;
6. The appliance with the sub-slot is only located on certain teeth or tooth.

[0052] During treatment, a round archwire within the archwire slots of brackets enters the sub-slots when teeth are tipped, so that a small anchorage is needed for moving the teeth. In this case, if a conventional molar tube is located on the molar of the same dental arch, the molar functioned as a sturdy anchorage in its bodily movement is steady enough to retract the anterior teeth without utilizing extraoral anchorage or implant anchorage. When a rectangular archwire is employed, the rectangular archwire cannot enter into the sub-slots, so that the teeth are uprighted and torqued. When a thin round archwire is employed under tight ligation, the thin round archwire hindered by the sidewall between the sub-slot and the bottom wall cannot enter the sub-slot sufficiently so that the teeth are aligned. Whether the dental archwire can enter into the sub-slots of the sidewalls or not may be influenced by the following factors: (1) the position and the shape of the sub-slot of the sidewall of an archwire slot, (2) the shape of the archwire slot, (3) ligation manners, and (4) the shape and the size of the dental archwires in the archwire slot. The largest mesiodistal inclination of a tooth is controlled by the width and the depth of the sub-slot as well as the shape and size of the dental archwire used in the bracket.

[0053] Another situation is that during treatment a round archwire gradually enters into the sub-slot of the molar tube when a molar is tipped, at this time a small anchorage is needed for moving the molar; when a rectangular archwire is utilized, the rectangular archwire can not enter into the sub-slot of the molar tube on an inclined molar, so that the molar is uprighted and torqued.

[0054] With employing the design of the sub-slot, the room for a round wire in the archwire slots is greatly improved and it is beneficial for tipping a tooth, opening deep bite and moving a tooth under a light force without using implant anchorage or extraoral anchorage. Because the rectangular wire cannot enter into the sub-slot, the tooth is uprighted by employing the rectangular wire. So by employing different archwires in the same archwire slot the tooth generates different kinds of movements. Furthermore, comparing to traditional orthodontic appliance for tipping movement, the structure of this orthodontic appliance is simple and the operation is easy. The operation for teeth uprighting is complicated and inconvenient when employing a traditional orthodontic appliance, such as Begg or Tip-Edge appliance, because an uprighting spring and/or auxiliary archwires are required to achieve the purpose.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055] The present invention will be further explained in detail with reference to the accompanying drawings and the description below, in the drawings:

Figure 1 is a front view of the structure of an orthodontic appliance according to the first embodiment of the present invention;

Figure 2 is a right view of the structure of the orthodontic appliance according to the first embodiment of the present invention;

Figure 3 is a top view of the structure of the orthodontic appliance according to the first embodiment of the present invention;

Figure 4 is a sectional view of the structure of the orthodontic appliance according to the first embodiment of the present invention, taken along line A-A of Figure 1;

Figure 5 is a perspective view of the structure of the orthodontic appliance according to the first embodiment of the present invention;

Figure 6 is a front view of the structure of an orthodontic appliance according to the second embodiment of the present invention;

Figure 7 is a left view of the structure of the orthodontic appliance according to the second embodiment of the present invention;

Figure 8 is a top view of the structure of the orthodontic appliance according to the second embodiment of the present invention;

Figure 9 is a sectional view of the structure of the orthodontic appliance according to the second embodiment of the present invention, taken along line A-A of Figure 6;

Figure 10 is a perspective view of the structure of the orthodontic appliance according to the second embodiment of the present invention;

Figure 11 is a front view of the orthodontic appliances of the present invention employing a thick round archwire for tipping teeth;

Figure 12 is a right view of the bracket of the present invention employing the thick round archwire for tipping teeth;

Figure 13 is a partial enlarged view of Figure 11;

Figure 14 is a front view of the orthodontic appliances of the present invention employing a thin round archwire for tooth aligning;

Figure 15 is a right view of the bracket of the present invention employing the thin round archwire for tooth aligning;

Figure 16 is a partial enlarged view of Figure 14;

5 Figure 17 is a front view of the orthodontic appliances of the present invention employing a rectangular archwire for uprighting teeth;

Figure 18 is a right view of the bracket of the present invention employing the rectangular archwire for uprighting teeth;

10 Figure 19 is a partial enlarged view of Figure 17;

Figure 20 is a front view of the structure of an orthodontic appliance according to the third embodiment of the present invention;

15 Figure 21 is a right view of the structure of the orthodontic appliance according to the third embodiment of the present invention;

Figure 22 is a top view of the structure of the orthodontic appliance according to the third embodiment of the present invention;

20 Figure 23 is a sectional view of the structure of the orthodontic appliance according to the third embodiment of the present invention, taken along line A-A of Figure 20;

25 Figure 24 is a front view of the structure of an orthodontic appliance according to the fourth embodiment of the present invention;

Figure 25 is a right view of the structure of the orthodontic appliance according to the fourth embodiment of the present invention;

30 Figure 26 is a top view of the structure of the orthodontic appliance according to the fourth embodiment of the present invention;

Figure 27 is a sectional view of the structure of the orthodontic appliance according to the fourth embodiment of the present invention, taken along line A-A of Figure 24;

35 Figure 28 is a front view of the structure of an orthodontic appliance according to the fifth embodiment of the present invention;

40 Figure 29 is a right view of the structure of the orthodontic appliance according to the fifth embodiment of the present invention;

Figure 30 is a top view of the structure of the orthodontic appliance according to the fifth embodiment of the present invention;

45 Figure 31 is a sectional view of the structure of the orthodontic appliance according to the fifth embodiment of the present invention, taken along line A-A of Figure 28;

Figure 32 is a front view of the section on the sidewall plane of the orthodontic appliance according to the fifth embodiment of the present invention.

50

List of Reference Signs:

[0056]

55

- | | |
|---------------------------------|--|
| 1. Bracket body | 19. Gingival sidewall of the archwire slot of the molar tube |
| 2. Bracket base | 20. Bottom wall of the archwire slot of |
| 3. Archwire slot of the bracket | |

(continued)

		the molar tube
5	4. Occlusal sidewall of the archwire slot of the bracket	21. Sub-slot of the sidewall of the archwire slot of the molar tube
	5. Gingival sidewall of the archwire slot of the bracket	23. Tie wing of the molar tube
10	6. Bottom wall of the archwire slot of the bracket	24. Traction hook of the molar tube
	7. Sub-slot of the sidewall of the bracket	25. Mesial edge of the sidewall of the archwire slot of the molar tube
	8. Ligation wire slot	26. Distal edge of the sidewall of the archwire slot of the molar tube
15	10. The median line of the sub-slot	27. Tie wire
	11. Tie wing of the bracket	28. Thick round archwire
20	12. Mesial edge of the sidewall of the archwire slot of the bracket	29. Thin round archwire
	13. Distal edge of the sidewall of the archwire slot of the bracket	30. Rectangular archwire
	14. Body of the molar tube	31. The median line of the section of the sub-slot
25	15. Base of the molar tube	32. The labial edge of the section of the sub-slot
	16. Archwire slot of the molar tube	33. The lingual edge of the section of the sub-slot
30	17. Top wall of the archwire slot of the molar tube	
	18. Occlusal sidewall of the archwire slot of the molar tube	

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

[0057] Referring to Fig. 1 through Fig. 5, this orthodontic appliance is a bracket which has a body 1 with an opening through archwire slot 3 extending mesiodistally and horizontally and a base 2 connected to the crown of a tooth. The archwire slot 3 has an occlusal sidewall 4, a gingival sidewall 5 and a bottom wall 6. The occlusal sidewall 4 is parallel to the gingival sidewall 5, and the sidewalls are perpendicular to the bottom wall 6. The sub-slot 7 extending mesiodistally and opening to the archwire slot 3 is located in the sidewalls of the archwire slot 3. There are four sub-slots 7 extending mesiodistally respectively from the mesial edges 12 and the distal edges 13 of the sidewalls of the bracket. The buccolingual width of the sub-slot 7 is smaller than that of the rectangular archwire 30 (see Figs. 17 to 19) employed in the orthodontic appliance. The sub-slot 7 has the largest occlusogingival depth and buccolingual width at the mesial edge and the distal edge of the sidewalls of the archwire slot and becomes gradually shallower and narrower when extending mesiodistally. A round archwire usually enters most deeply into the sub-slot 7 at the mesial edge and the distal edge of the sidewalls when a tooth is tipped and gradually comes out of the sub-slot 7 mesiodistally, so that the configuration of the sub-slot 7 fits the round archwire very well. It is illustrated that the sub-slot 7 has a triangular cross section perpendicular to the mesiodistal direction, the sub-slot 7 consists of two guiding surfaces at a acute angle such as 45° relative to the sidewall, the two guiding surface meet at the median line 10 oriented mesiodistally of the sub-slot 7. The median line 10 is parallel to the bottom wall, and the distance between the median line 10 and the bottom wall is a little larger than the radius of the thick round archwire 28 (see Figs. 11 to 13) for tipping teeth in the archwire slot. The median plane of the sub-slot 7 is in the same plane with the median line of the thick round archwire 28, and this plane is parallel to the bottom wall. The sidewall between the sub-slot 7 and the bottom wall 6 has the smallest buccolingual width at the mesial edge and the distal edge of the sidewalls and gradually become wider.

[0058] The mesial edge 12 and the distal edge 13 of the sidewalls of the archwire slot intersect with the bottom wall

6 at an angle of about 60°. Tie wings are employed as the ligation device of the bracket. Specifically, two pairs of tie wings 11 are provided on the outside surface of the sidewalls of the archwire slot and project outwardly from the mesial part and the distal part of the sidewalls, respectively.

Second Embodiment

[0059] Referring to Fig. 6 through Fig. 10, this orthodontic appliance is a molar tube which has a body 14 with a through archwire slot 16 extending mesiodistally and horizontally and a base 15 connected to the crown of a tooth. The archwire slot 16 has an occlusal sidewall 18, a gingival sidewall 19, a bottom wall 20 and a top wall 17. The occlusal sidewall 18 is parallel to the gingival sidewall 19, and the sidewalls are perpendicular to the bottom wall 20. A traction hook 24 is provided on the outside surface of the gingival sidewall 19 of the archwire slot 16. The sub-slot 21 extending mesiodistally and opening to the archwire slot 16 is located in the sidewalls of the archwire slot 16. There are four sub-slots 21 extending mesiodistally from the mesial edges 25 and the distal edges 26 of the sidewalls respectively. The buccolingual width of the sub-slot 21 of the molar tube is smaller than that of the rectangular archwire 30 (see Figs. 17 to 19) employed in the orthodontic appliance. The sub-slot 21 of the molar tube has the deepest and widest section at the mesial edge 25 or the distal edge 26 of the sidewalls of the archwire slot and becomes gradually shallower and narrower when extending mesiodistally. It is illustrated that the sub-slot 21 has a triangular cross section perpendicular to the mesiodistal direction. The configuration of the sub-slot 21 is similar to that of the sub-slot 7 of the first embodiment. The median plane of the sub-slot 21 is parallel to the bottom wall 20. The mesial edge 25 and the distal edge 26 of the sidewalls are perpendicular to the bottom wall 20.

[0060] The orthodontic appliances of this invention coact with different archwires to realize different teeth movements, as illustrated in Figs. 11 to 19. The diameter of the thick round wire 28 is larger than that of the thin round wire 29, and the diameter of the thick round wire 28 is smaller than the buccolingual width of the rectangular wire 30. Referring to Figs. 14, 15 and 16, when aligning teeth, the thin round archwire 29 is pushed to the bottom wall 6 of the bracket by a tie wire 27; because it is tied in a tight ligation manner, the thin round archwire 29 hindered by the sidewall between the sub-slot 7 and the bottom wall 6 can not enter into the sub-slot 7 of the bracket sufficiently, this configuration works to align the teeth. Referring to Figs. 11, 12 and 13, when tipping teeth, the thick round archwire 28 is bound in the archwire slot by the tie wire 27, the sub-slot is adapted to allow the thick round archwire 28 to enter the sub-slot so that the thick round archwire 28 can enter into the sub-slot. Referring to Figs. 17, 18 and 19, when uprighting and torquing teeth, the rectangular wire 30 is bound in the archwire slot by the tie wire 27. The rectangular wire 30 can not enter into the sub-slot of the sidewall because the rectangular wire 30 has a larger width in the buccolingual direction than that of the sub-slot. Therefore, the uprighting and torquing movement of teeth occurs.

Third Embodiment

[0061] Referring to Fig. 20 through Fig. 23, this orthodontic appliance is a bracket. The bracket of the present embodiment is different from that of the first embodiment in that (1) the mesial edge 12 and the distal edge 13 of the sidewalls of the archwire slot intersect with the bottom wall 6 at an angle of about 15°; (2) a pair of tie wings 11 locate on the outside surface of the sidewalls of the archwire slot; (3) each sidewall of the archwire slot 3 has one sub-slot 7 extending through mesiodistally, and the shape of the cross sections perpendicular to the mesiodistal direction of the sub-slot 7 is triangular and identical.

[0062] The median line of the sub-slot 7 is parallel to the bottom wall 6, and the distance between the median line and the bottom wall is a little larger than the radius of the thick round wire, and the sidewalls are formed on the buccal side and the lingual side of the sub-slot 7.

[0063] The mesial edge 12 and the distal edge 13 of the sidewalls intersect with the bottom wall 6 at an angle of about 15°. When tipping teeth, the mesial edge 12 and the distal edge 13 of the sidewalls can lead the dental archwire to the sub-slot 7.

Fourth Embodiment

[0064] Referring to Fig. 24 through Fig. 27, this orthodontic appliance is a molar tube. The molar tube of the present embodiment is different from that of the second embodiment in that (1) the mesial edge 25 and the distal edge 26 of the sidewalls of the archwire slot 16 intersect with the bottom wall 20 at an angle of about 15°; (2) two pairs of tie wings 23 locate on the outside surface of the sidewalls; (3) each sidewall of the archwire slot 16 has one sub-slot 21 extending through mesiodistally, and the sub-slot 21 extends through each sidewall occlusogingivally at the mesial and the distal edge of the sidewalls.

[0065] Without using tie wire the archwire can enter the sub-slot 21 of the sidewall; when employing a tight ligation manner, a tie wire passing by the mesial edge 25 and the distal edge 26 of the sidewalls has great restriction to the thin

round archwire so that the archwire can not enter the sub-slot 21, which is beneficial for teeth alignment.

Fifth Embodiment

[0066] Referring to Fig. 28 through Fig. 31, this orthodontic appliance is a straight-wire bracket. The straight-wire bracket of the present embodiment is different from that of the first embodiment in that (1) the mesial edge 12 and the distal edge 13 of the sidewalls of the archwire slot is perpendicular to the bottom wall 6; (2) the sub-slot 7 has a arc cross section perpendicular to the mesiodistal direction; (3) at the mesial edge and the distal edge of the sidewalls the sub-slot is next to the bottom wall, and the buccolingual width of the sidewall between the sub-slot and the bottom wall is smallest at the mesial edge and the distal edge of the sidewalls and gradually become larger when extending mesiodistally; (4) the bottom wall 6 extends beyond the archwire slot 3 mesiodistally, and the part of the bottom wall out of the archwire slot becomes wider occlusogingivally.

[0067] Referring to Fig. 32, the median line 31 of the section on the sidewall plane of the sub-slot is parallel to the bottom wall, and the distance between the median line 31 and the bottom wall 6 is generally equal to the radius of the thick round wire 28, the distance from a point in the median line 31 to the labial edge 32 is equal to that from the point to the lingual edge 33.

Claims

1. An orthodontic appliance which has a base connected to the crown of a tooth and coacts with an archwire passing through the appliance mesiodistally, the appliance having at least one archwire slot which extends through the appliance mesiodistally and has a bottom wall and sidewalls which include an occlusal sidewall and a gingival sidewall being parallel to each other;
wherein the archwire slot has at least one sub-slot which is located in the sidewalls of the archwire slot and opens to the archwire slot,
wherein at least one end of the sub-slot starts from the mesial edge or the distal edge of the sidewalls,
wherein the buccolingual width of the sub-slot is at least in some section smaller than that of a rectangular archwire employed for uprighting teeth, and
wherein the configuration of the sub-slot is adapted to allow a round archwire to enter the sub-slot when the tooth is tipped.
2. The orthodontic appliance of claim 1, wherein the sidewall is formed on the buccal side and the lingual side of at least part of the sub-slot.
3. The orthodontic appliance of claim 1, wherein the buccolingual width of the sub-slot is smaller than that of the rectangular archwire employed for uprighting teeth.
4. The orthodontic appliance of claim 1, wherein the depth of the sub-slot may extend through the sidewalls occlusogingivally, or may extend occlusogingivally and terminate in the sidewalls.
5. The orthodontic appliance of claim 1, wherein the sub-slot may extend through the sidewalls mesiodistally, or may extend mesiodistally and terminate in the sidewalls.
6. The orthodontic appliance of claim 1, wherein the sub-slot has the largest buccolingual width at the mesial edge and the distal edge of the sidewalls and gradually becomes narrower when extending mesiodistally.
7. The orthodontic appliance of claim 6, wherein the shape of the cross section perpendicular to the mesiodistal direction of the sub-slot is triangle, and wherein the sub-slot consists of two guiding inclined surfaces at an acute angle relative to the sidewall, wherein the two guiding inclined surfaces meet at a line considerably parallel to the bottom wall.
8. The orthodontic appliance of claim 6, wherein the median line of the section on the sidewall plane of the sub-slot is considerably parallel to the bottom wall.
9. The orthodontic appliance of claim 8, wherein the distance between the median line and the bottom wall is generally equal to the radius of the round archwire employed for tipping teeth.
10. The orthodontic appliance of claim 1, wherein the sub-slot has the largest occlusogingival depth at the mesial edge

and the distal edge of the sidewalls and gradually becomes shallower when extending mesiodistally.

11. The orthodontic appliance of claim 1, wherein the shape of the cross section perpendicular to the mesiodistal direction of the sub-slot may be triangular, arc, trapezoidal or rectangular.

5 12. The orthodontic appliance of claim 1, wherein the sidewall between the sub-slot and the bottom wall has the smallest buccolingual width at the mesial edge and the distal edge of the sidewalls and gradually become wider.

10 13. The orthodontic appliance of claim 1, wherein at least part of the sub-slot is separated from the bottom wall by the sidewall.

14. The orthodontic appliance of claim 1, wherein the sub-slot is located in a discrete sidewall, wherein one end of the sub-slot may start from the mesial edge of the mesial section of the sidewall or the distal edge of the distal section of the sidewall.

15

20

25

30

35

40

45

50

55

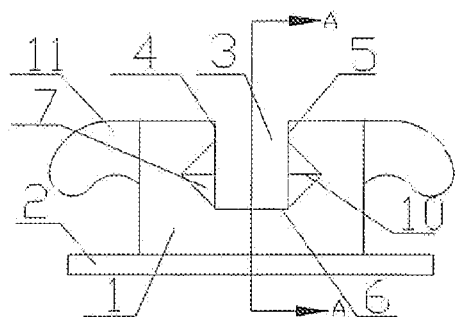


Fig.1

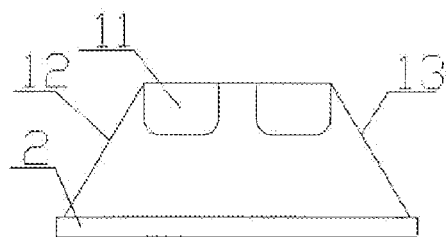


Fig.2

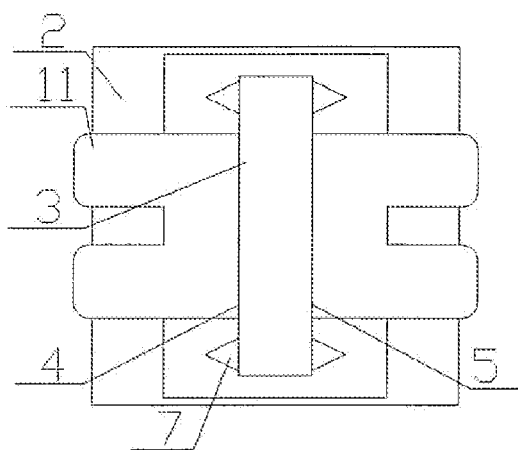


Fig.3

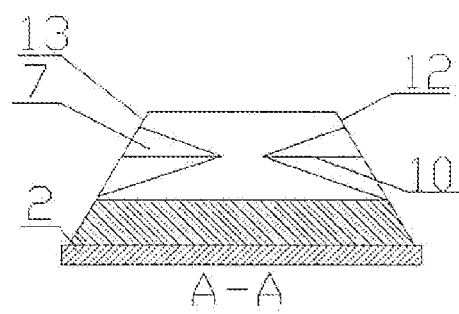


Fig.4

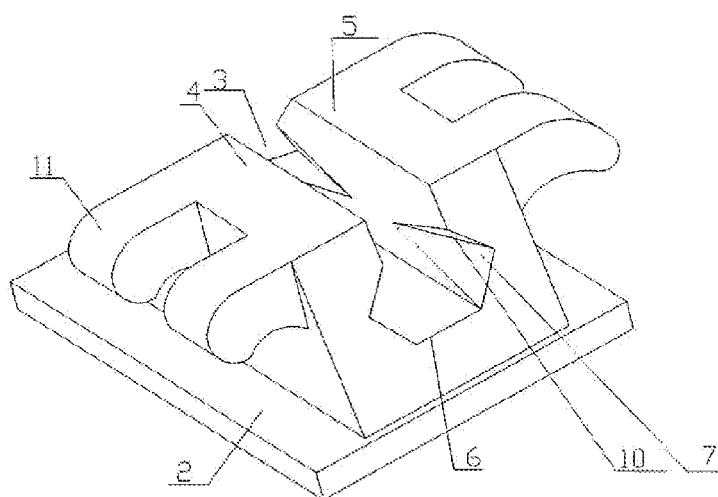


Fig.5

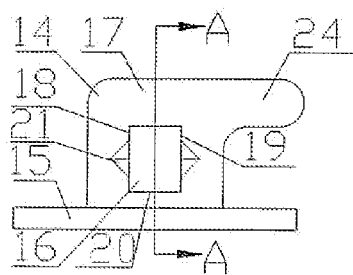


Fig.6

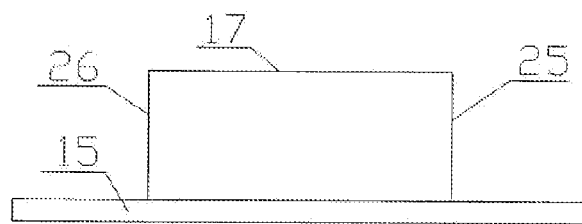


Fig.7

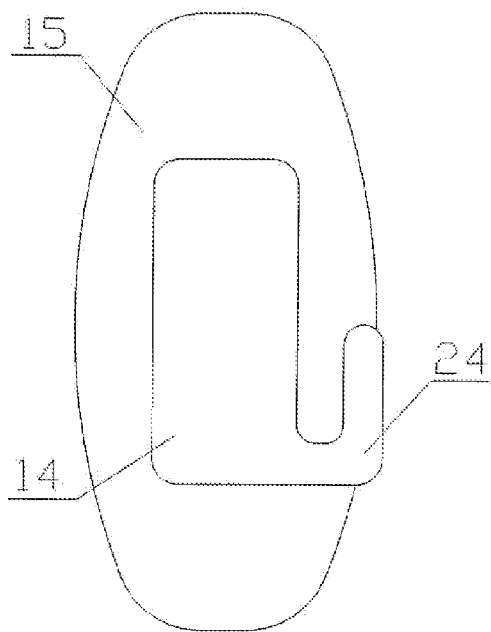
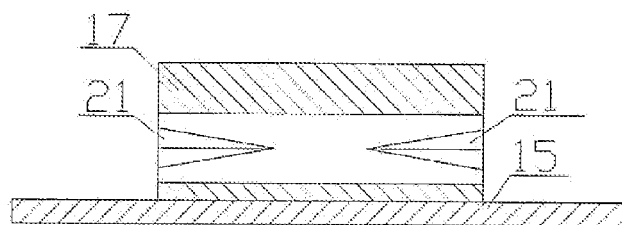


Fig.8



A-A

Fig.9

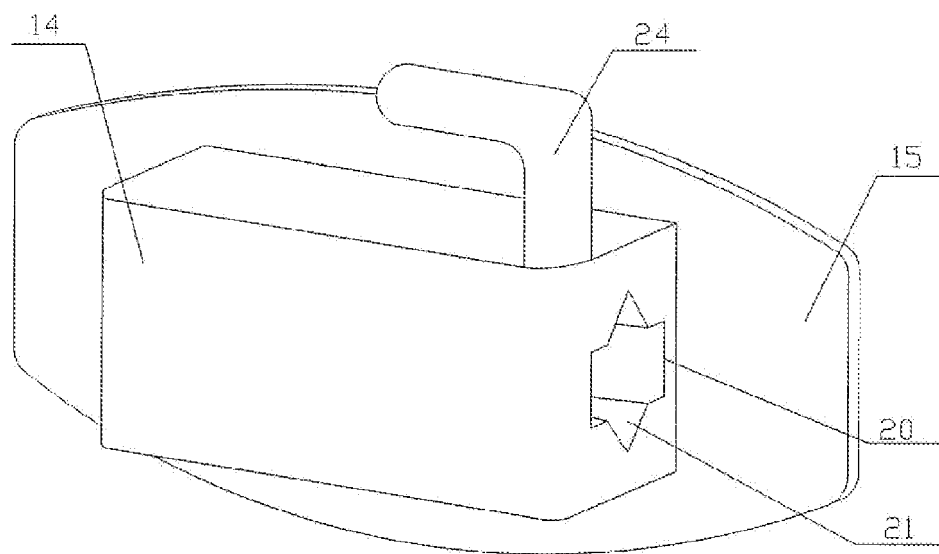


Fig.10

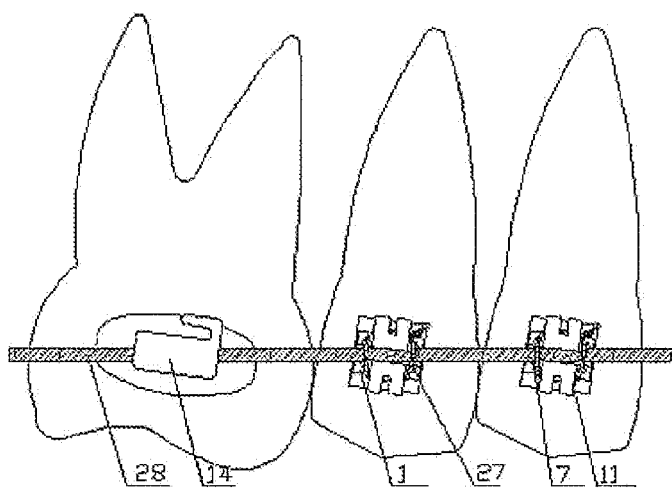


Fig.11

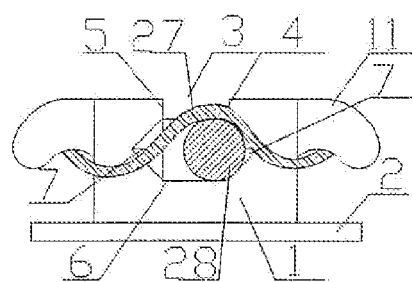


Fig.12

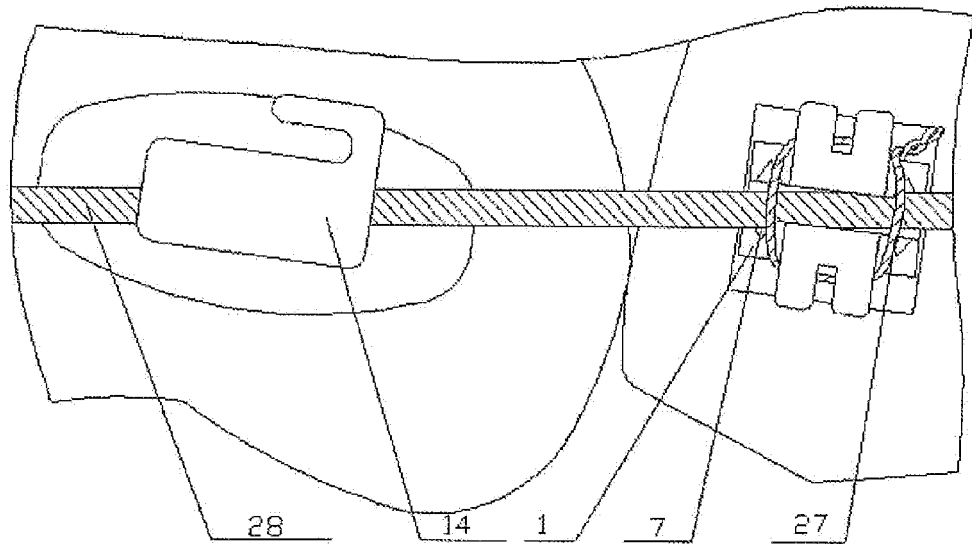


Fig.13

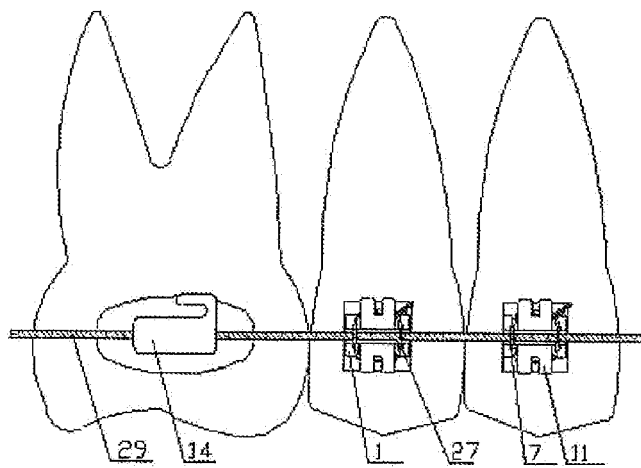


Fig.14

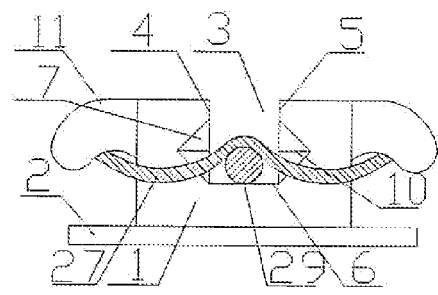


Fig.15

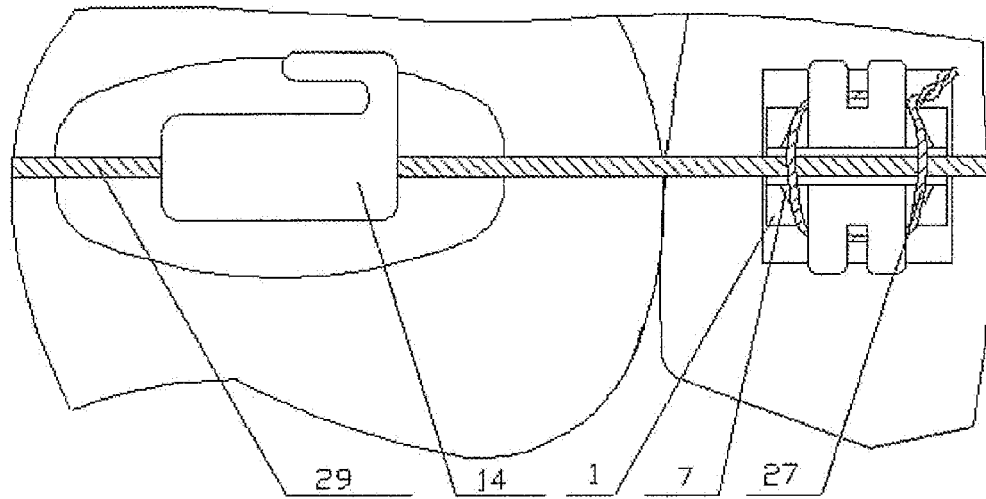


Fig.16

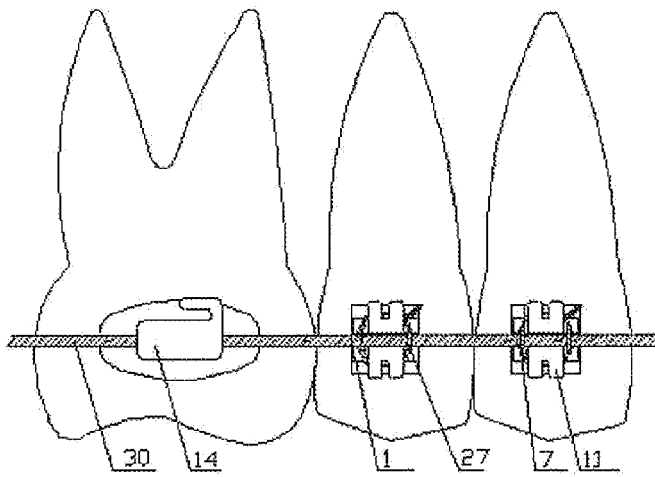


Fig.17

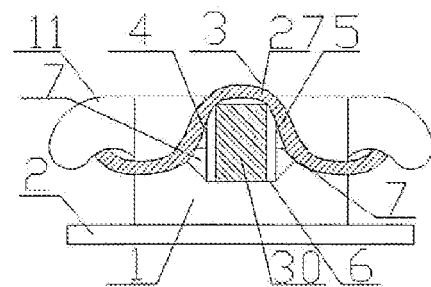


Fig.18

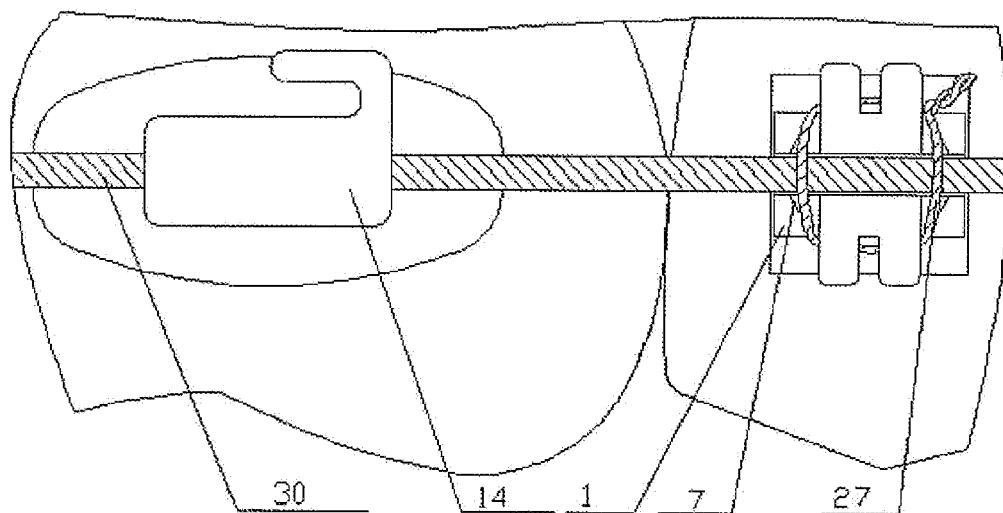


Fig.19

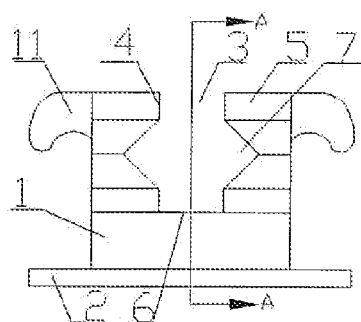


Fig.20

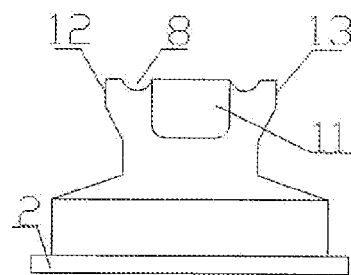


Fig.21

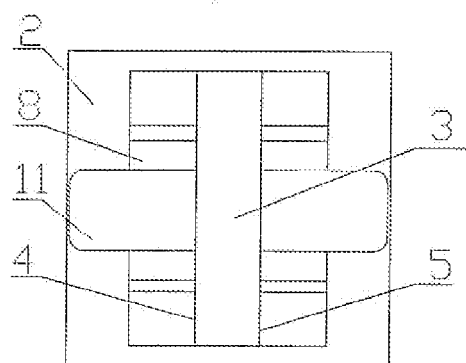
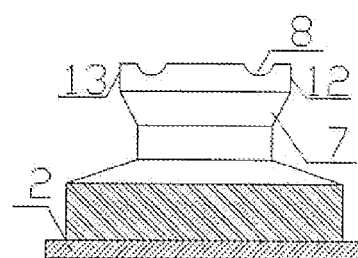


Fig.22



A-A

Fig.23

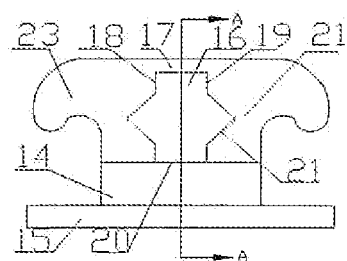


Fig.24

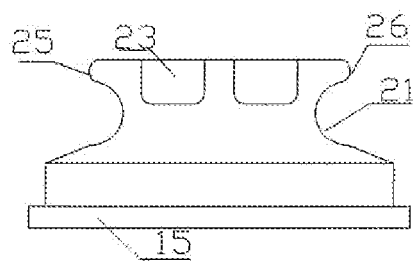


Fig.25

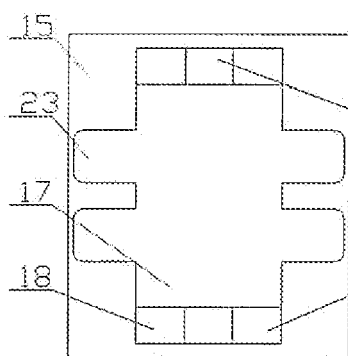
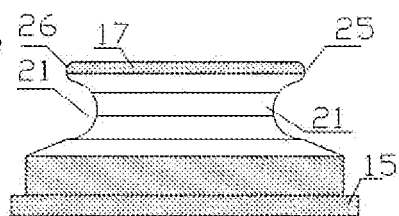


Fig.26



A-A

Fig.27

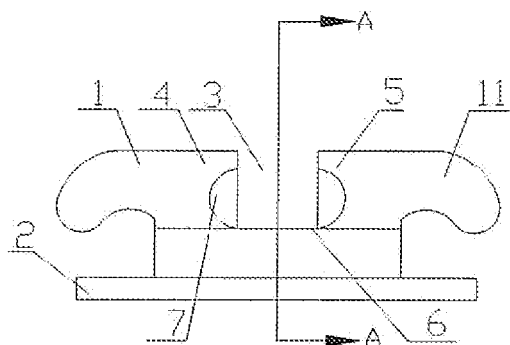


Fig.28

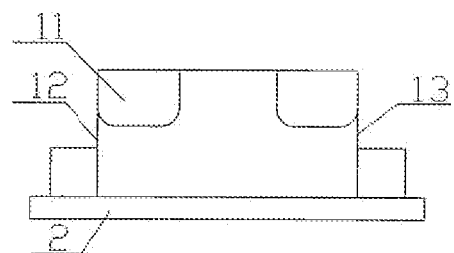


Fig.29

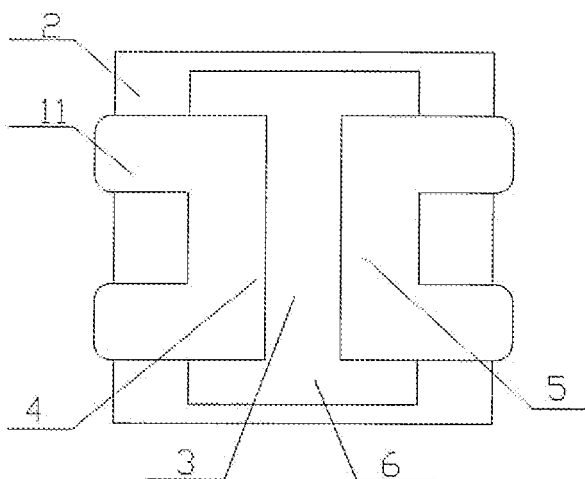
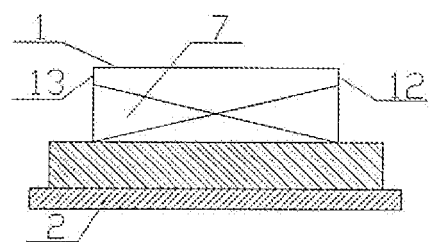


Fig.30



A-A

Fig.31

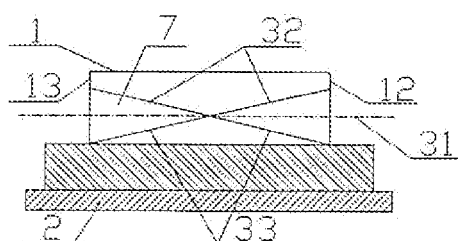


Fig.32



EUROPEAN SEARCH REPORT

Application Number
EP 08 16 9008

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 03/045266 A (TADDEI YANN SOFIAN [GB]) 5 June 2003 (2003-06-05) * page 7, paragraph 3 * * figure 10 *	1-14	INV. A61C7/14
X	----- US 4 531 911 A (CREEKMORE THOMAS D [US]) 30 July 1985 (1985-07-30) * column 10, line 55 - column 11, line 56 * * figures 5-7 *	1-14	
A	----- US 4 353 692 A (KARRAKUSSOGLU STEFANOS) 12 October 1982 (1982-10-12) * column 6, lines 46-58 * * figure 22 * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A61C
Place of search		Date of completion of the search	Examiner
The Hague		20 February 2009	Chabus, Hervé
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 16 9008

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
W0 03045266 A	05-06-2003	AU 2002347307 A1	10-06-2003

US 4531911 A	30-07-1985	AU 564082 B2	30-07-1987
		AU 3800385 A	31-07-1986
		BE 902097 A2	31-07-1985
		CH 668548 A5	13-01-1989
		DE 3511632 A1	09-10-1986
		DK 113385 A	13-09-1986
		FI 851075 A	19-09-1986
		FR 2589717 A1	15-05-1987
		GB 2174603 A	12-11-1986
		LU 85958 A1	22-01-1986
		NL 8500743 A	01-10-1986
		SE 453885 B	14-03-1988
		SE 8501578 A	30-09-1986

US 4353692 A	12-10-1982	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 200710114988 [0001]
- CN 200810002164 [0001]
- US 4877398 A [0006]